

# Preliminary - For Review Only

## NAVSEA STANDARD ITEM

FY-06

ITEM NO: 009-33  
DATE: 29 JUL 2004  
CATEGORY: II

### 1. SCOPE:

1.1 Title: Rotating Electrical Equipment; rewind

### 2. REFERENCES:

2.1 Standard Items

2.2 Equipment Technical Manual

2.3 S9086-KC-STM-010/CH-300, Electric Plant - General

2.4 S9086-KE-STM-000/CH-302, Electrical Motors and Controllers

2.5 S9086-KN-STM-010/CH-310, Electrical Power Generators and Conversion Equipment

2.6 S9086-HN-STM-010/CH-244, Propulsion Bearings and Seals

2.7 0900-LP-060-2010, Electrical Machinery Repair, Volume One, Electrical Motor Repair, Shop Procedures Manual

2.8 S9310-AC-HBK-010, Commutator/Slip Ring Maintenance Handbook

2.9 MIL-STD-1310, Shipboard Bonding, Grounding, and Other Techniques for Electromagnetic Compatibility and Safety

### 3. REQUIREMENTS:

3.1 Accomplish preliminary repair preparations as follows:

3.1.1 Prior to disconnecting equipment:

3.1.1.1 Record and retain electrical hook-up data. Record and retain air gap readings. Record and retain bearing clearances for sleeve bearing equipment only.

3.1.1.2 Inspect couplings for cracks, broken segments, wear, and misalignment in excess of tolerances specified in 2.2.

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3.1.2 Disconnect the equipment electrically and mechanically, using 2.2 for guidance.

3.1.2.1 Matchmark, identify, and retain chocks, shims, shock mounts, sound damping pads, and other accessories associated with equipment.

3.1.2.2 Record shaft thrust and run out readings.

3.2 Remove equipment including rotating components connected directly to the shaft.

3.3 Inspect foundations for cracks, areas of distortion, and deterioration in excess of 25 percent of the thickness of each member of the structure.

3.4 Submit one legible copy, in hard copy or electronic media, of a report listing inspection results, missing parts, defective parts, and measurements taken in 3.1 and 3.3 to the SUPERVISOR.

3.5 Matchmark, disassemble and inspect the equipment removed in 3.2, using 2.2 through 2.7 for guidance.

3.5.1 Accomplish a core loss test prior to winding removal in accordance with Paragraphs 300-4.5.6 and 300-4.5.6.1 of 2.3. Record data.

3.5.1.1 Inspect for hot spots in accordance with the Core Loss Tester Instruction Manual.

3.5.1.2 Conduct a loop test in accordance with Paragraph 300-4.5.6.1.2 of 2.3 when core indicates a marginal satisfactory reading or when test equipment does not directly support equipment being subjected to testing.

3.5.2 Remove each winding, using Paragraph 300-4.5.7.2 of 2.3 for guidance for winding removal and 2.7 for core inspection.

3.5.2.1 Verify the temperature limitations of the core material prior to exercising the burnout oven option.

3.5.2.2 Record winding data. Verify conformance of recorded data to the manufacturer's winding data.

3.5.2.3 Accomplish a core loss test after winding removal in accordance with Paragraph 300-4.5.6 and 300-4.5.6.1 of 2.3. Record data.

3.5.2.4 Inspect for hot spots in accordance with the Core Loss Tester Instruction Manual.

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3.5.2.5 Dip core iron in a 20 percent solution of varnish MIL-I-24092 and dry. In localities where MIL-I-24092 does not meet state and local Air Pollution Control District (APCD) standards, spray the iron core with a clear air drying varnish.

3.5.3 Protect machined surfaces and clean the equipment housing exterior, fan(s), core iron, and interior and exterior of end bells to bare metal.

3.5.3.1 Prime equipment housing, fan(s), and end bells with one coat F-84 Alkyd Zinc Molybdate TT-P-645 (1.5 mils dry film thickness).

3.6 Inspect non-wound rotors for loose or cracked bars, localized overheating, and rubbing. Inspect wound rotors, slip ring leads, and armatures for insulation damage and burns/hot spots. Inspect for loose coils and slot wedges. Inspect slip rings and commutators for damage and for wear limits, using 2.2 for criteria. Record data.

3.7 Inspect and dimensionally measure end bells, frame, rabbet fits, shaft, sleeve and pedestal bearings, keyways, fan and running surfaces for wear, eccentricity, and other defects, using 2.2 for accept or reject criteria, and 2.6 for location and type of measurements to be taken. Record data.

3.8 Inspect brush rigging for cracks, chips, worn areas, distortion, spring condition, and insulating material for cracks and arc paths. Record data.

3.9 Accomplish commutator pre-installation and post-installation test, using Table 300-3-9 of 2.3 for guidance. Record data.

3.10 Submit one legible copy, in hard copy or electronic media, of a report listing results of the requirements of 3.5 through 3.9 to the SUPERVISOR.

3.11 Rewind the equipment in accordance with Original Equipment Manufacturer's (OEM) "for Navy use" winding data.

3.11.1 Do not permanently connect winding until after successful completion of testing of 3.11.3 through 3.11.6.

3.11.2 Material shall conform to:

3.11.2.1 Magnet wire, National Electrical Manufacturers Association (NEMA) MW-1000, Table MW 16 (round wire), or NEMA MW-1000, Table MW 20 (rectangular wire), or equivalent to OEM original.

3.11.2.2 Slot and phase insulation, MIL-I-24204.

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3.11.2.3 Slot wedge-spacers and fillers, MIL-I-24768/17.

3.11.2.4 Lead wire, stranded, MIL-DTL-16878.

3.11.2.5 Glass banding, MIL-I-24178.

3.11.2.6 New temperature detectors in accordance with 2.2.

(V) "INSULATION RESISTANCE TEST"

3.11.3 Accomplish 500 volt megger insulation resistance test, using Paragraphs 300-3.2.2 through 300-3.2.3, 300-3.4.8, 300-3.4.11, and 300-5.3.7.1 of 2.3 for guidance.

(V) "DC RESISTANCE TEST"

3.11.4 Accomplish a DC resistance test of windings, using a Wheatstone or Kelvin bridge, or with an ohmmeter capable of resolving one milliohm (0.001 ohm). Record phase balance for multi-phase equipment, using Paragraph 5.22 of 2.7 for guidance.

(V) "VOLTAGE SURGE TEST"

3.11.5 Accomplish a voltage surge test in accordance with Paragraphs 300-3.5.4 through 300-3.5.5 of 2.3.

(V) "DC HI POT TEST"

3.11.6 Accomplish a DC HI POT test in accordance with Paragraph 300-3.5.2 through 300-3.5.2.3.4 of 2.3.

3.12 Permanently connect the windings.

3.12.1 Repeat tests described in 3.11.3 through 3.11.6

(V) "BAR-TO-BAR TEST"

3.12.2 Accomplish DC bar-to-bar test on commutators after making coil connections to the risers in accordance with Paragraph 300-4.7.11.2 of 2.3.

(V) "VARNISH TEMPERATURE, VISCOSITY, AND GEL TIME TESTS"

3.13 Select the proper insulation process based on winding insulation classifications and to meet state or local air pollution standards.

3.13.1 Select varnish methods and material, using Paragraphs 300-4.5.8 through 300-4.5.8.2 of 2.3 for guidance.

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3.13.1.1 Maintain the varnish in accordance with Paragraphs 300-4.5.8.3 through 300-4.5.8.3.3 of 2.3 and the varnish manufacturer's instructions.

3.13.1.2 Maintain a current revision of the varnish manufacturer's instructions on storage, maintenance, and use of the type of varnish to be applied.

3.13.1.3 Maintain a record of varnish temperature, viscosity, and, for solventless varnish, gel time tests. Tests must show varnish is within varnish manufacturer's recommendations and have been accomplished in the intervals specified by the varnish manufacturer. The record must also show the varnish is being stored as recommended by the varnish manufacturer.

3.14 Varnish windings in accordance with Paragraphs 300-4.5.8.2 of 2.3 and the varnish manufacturer's instructions.

3.14.1 Do not immerse the leads.

3.14.2 Wipe surfaces that affect assembly such as rabbet fits and mounting flanges with a cloth moistened with a solvent after draining and before baking.

3.15 Remove excess varnish runoff from the component locations described in 3.14.2 after final baking. Apply a thin coat of air dry varnish to metal surfaces exposed by the removal process in accordance with Paragraphs 300-4.5.8.5 and 300-4.5.8.6 of 2.3.

3.16 Repeat tests described in 3.11.3 through 3.11.6. Record data.

3.17 Accomplish an AC HI POT test in accordance with Paragraphs 300-3.5.3 through 300-3.5.3.2.9 of 2.3. Record data.

3.18 Accomplish a 500-volt megger insulation resistance test, using Paragraphs 300-3.2.2 through 300-3.2.3, 300-3.4.8, 300-3.4.11, and 300-5.3.7.1 of 2.3 for guidance. Record data.

3.19 Measure resistance value of each winding temperature detector, using a low voltage ohmmeter. Record data.

3.20 Submit one legible copy, in hard copy or electronic media, of a report listing the results of the requirements of 3.16 through 3.19 to the SUPERVISOR.

3.21 True the commutator or collector rings. Eccentricity shall not exceed the requirements of 2.8. Resurface or machine each individual collector ring to the same exact diameter to allow symmetrical brush holder to ring clearance spacing. Ensure metal shavings are not permitted to contaminate the rotor or stator assembly.

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3.21.1 Each cut shall not exceed 0.010 inch. Finish thickness shall not be less than design wear tolerance as shown in 2.2.

3.21.2 Undercut the mica between the commutator bars with the edge of the mica not exceeding a depth of 5/64-inch below the bars.

3.21.3 Chamfer the bar edges and remove rough surfaces in accordance with Paragraph 5-2-4 of 2.8.

3.21.4 Burnish the commutator with a very fine commercial burnishing stone conforming to A-A-58052. Polish collector rings to a mirror finish.

3.22 Accomplish the requirements of 009-15 of 2.1 for each rotating assembly.

3.23 Accomplish the following for the brush rigging:

3.23.1 Disassemble the brush rigging.

3.23.2 Remove foreign matter.

3.23.3 Replate existing cadmium-plated parts with zinc in accordance with ASTM A153 after removal of cadmium plating. Replate zinc-plated parts in accordance with ASTM A153.

3.23.4 Recondition threads of plated parts.

3.23.5 Assemble brush rigging.

3.24 Install identification markers on wiring in the external connection box.

3.24.1 Markers shall be aluminum wrap-around type with metal stamped or embossed markings.

3.25 Repair lightly scored areas of frame, end bells, and shaft by manual methods. Recondition threads and fit key to keyway. Step keys shall not be used.

3.25.1 Apply a thin coat of petrolatum to unpainted mating surfaces except for explosion-proof motors which shall have clean, dry mating surfaces.

3.26 Prepare and refinish equipment. Protect machine surfaces, windings, and nameplates from being painted or otherwise damaged.

3.26.1 Accomplish the requirements of 009-32 of 2.1 for each housing, fan, and interior and exterior of each end bell.

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3.27 Accomplish the requirements of 009-32 of 2.1 for the foundations of the equipment removed in 3.2.

3.28 Accomplish the following on equipment having other than sleeve-type bearings unless otherwise specified in the invoking Work Item, using 2.7 for guidance.

3.28.1 Install new bearings, seals, fittings, lock washers, and locknuts conforming to 2.2, using 2.6 and Chapter 6 of 2.7 for guidance.

3.28.1.1 Install new Type 111, Class 8 (sealed) bearings with a C3 radial internal clearance in vaneaxial and tubeaxial fan motors originally furnished with Type 111 bearings. Install Type 120 bearings in vaneaxial and tubeaxial fan motors originally furnished with Type 120 bearings.

3.28.1.2 Install new label plates with the inscription "DO NOT LUBRICATE" on equipment with sealed bearings (Type 111, Class 8 or Type 120).

3.28.2 Lubricate bearings with grease conforming to DOD-G-24508 as required in Paragraphs 244-1.7.7.2 and 244-1.7.7.3 of 2.6.

3.29 Assemble the equipment disassembled in 3.5, using 2.2 through 2.7 for guidance.

3.29.1 Do not use materials containing silicone in the repair and reassembly of equipment with commutator or collector rings.

3.29.2 Install new fasteners conforming to MIL-DTL-1222, Type I or II, Grade 5, zinc coated.

3.29.3 Fasteners requiring a permeability factor of 2.0 or less shall conform to Grade 304 CRES.

3.29.4 Install new gaskets on covers, inspection plates, and between the external connection box and the frame. Gaskets shall conform to MIL-PRF-1149 unless otherwise specified in 2.2.

3.29.5 Set brush holders not less than 1/16-inch or more than 1/8-inch from commutator or collector rings unless otherwise specified in 2.2.

3.29.6 Set brush holders in electrical neutral plane and stagger brushes for maximum coverage of the commutator, in accordance with Paragraph 300-4.7.7.1.10 of 2.3.

3.29.7 Center the brush holder over the collector rings.

3.29.7.1 Ensure the brushes do not extend beyond the edge of the collector rings.

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3.29.8 Install new brushes in accordance with 2.2. Sand new brushes to fit curvature of the commutator or collector rings, using Paragraphs 4-4-4.2 through 4-4-4.4 of 2.8 for guidance.

3.29.8.1 Brushes shall have a surface contact of 100 percent and shall not be chipped, cracked, or broken.

3.29.8.2 Remove sand, carbon, and other foreign matter resulting from fitting new brushes.

3.29.9 Adjust spring tension of brushes in accordance with 2.2.

3.29.10 Adjust air gap as specified in 2.2, plus or minus 10 percent.

3.29.11 Rotate shaft by hand a minimum of three revolutions. Rubbing or binding of rotating assembly not allowed.

3.29.12 Install label plates conforming to MIL-DTL-15024 for those found to be missing or damaged.

(V) (G) "NO-LOAD SHOP TEST"

3.30 Accomplish a no-load shop test of the motor for a minimum of one-half hour.

### ***3.30.1 Verify proper direction of rotation.***

3.30.2 After one-half hour, record current and voltage in each phase, speed and bearing temperature rise measured on the equipment's exterior near each bearing.

3.30.3 Submit one legible copy, in hard copy or electronic media, of the recorded data to the SUPERVISOR.

3.31 Install equipment removed in 3.2.

3.31.1 Remove existing and install new foundation fasteners conforming to MIL-DTL-1222, Type I or II, Grade 5, zinc coated, and self-locking hexagon nuts conforming to NASM-25027, excluding body-fitted bolts and studs.

3.31.2 Remove existing galled or distorted body-fitted bolts and studs and install new fitted bolts and studs conforming to MIL-DTL-1222, Type I, Grade 5.

3.31.3 Fasteners, body-fitted bolts, and studs requiring a permeability factor of 2.0 or less shall conform to Grade 304 CRES.



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3.31.4 Align equipment in accordance with 2.2. Measure and record facial and peripheral coupling data.

3.31.4.1 Install chocks, shims, shock mounts, and sound damping pads.

3.31.4.2 Accomplish the requirements of 009-58 of 2.1 for driver and pump shafts.

3.31.5 Connect electrical cables to equipment, using data retained in 3.1.1.1.

3.31.6 Bond and ground equipment in accordance with 2.9, using new ground straps.

3.31.7 Rotate shaft by hand a minimum of three revolutions. Rubbing or binding of rotating assembly not allowed.

3.31.8 Measure and record the air gap and bearing clearance (sleeve bearing equipment only), insulation resistance (at 500 volts DC), and thrust.

(V) (G) "OPERATIONAL TEST"

3.32 Accomplish an operational test of the equipment at full nameplate load or maximum system capacity for a minimum of one hour after temperatures stabilize, unless otherwise specified in the invoking Work Item.

3.32.1 Verify proper direction of rotation.

3.32.2 Verify/establish oxide film coating of the commutator/collector rings, using 2.8 for guidance.

3.32.3 Record current, voltage, frame and bearing temperature rise, and speed at 15 minute intervals.

3.32.3.1 Bearing temperatures shall not exceed 180 degrees Fahrenheit unless otherwise specified in the invoking Work Item/equipment technical manual.

3.32.4 Measure and record hot insulation resistances of windings to ground immediately upon completion of test, using a 500 volt megger.

3.33 Submit one legible copy, in hard copy or electronic media, of a report listing data recorded in 3.31.4, 3.31.8, 3.32.3, and 3.32.4 to the SUPERVISOR.

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### 4. NOTES:

4.1 Equipment technical manual and drawings will be listed in the invoking Work Item.

4.2 Shop test of generator will be addressed in the invoking Work Item.

4.3 The use of silicone is not allowed on any rotating electrical machinery with brushes.